

## Claims

What is claimed is:

1           1.     A method for implementing deterministic based broken scan  
2 chain diagnostics comprising the steps of:  
3           generating a deterministic test pattern;  
4           loading the deterministic test pattern into each scan chain in a device  
5 under test using lateral insertion via system data ports and applying system  
6 clocks;  
7           unloading each scan chain and identifying a last switching latch in  
8 each scan chain;  
9           repeating the generating, loading, and unloading testing steps a  
10 selected number of times; and  
11          checking for consistent results; and responsive to consistent results  
12 being identified, sending the identified last switching latch to a Physical  
13 Failure Analysis system.

1           2.     A method for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 1 further includes the steps responsive  
3 to consistent results not being identified, of selecting another deterministic  
4 test pattern; and repeating the testing steps a selected number of times.

1           3.     A method for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 1 wherein the step of generating a  
3 deterministic test pattern includes the steps of using a base deterministic  
4 test pattern set generated by an Automatic Test Pattern Generation (ATPG)  
5 system.

1           4.     A method for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 1 wherein the step of generating a  
3 deterministic test pattern includes the steps of using perturbations of one  
4 base deterministic test pattern from a base deterministic test pattern set  
5 generated by an Automatic Test Pattern Generation (ATPG) system.

1           5.     A method for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 4 wherein the step of using  
3 perturbations of one base deterministic test pattern includes the steps of  
4 applying said one base deterministic test pattern from the base deterministic  
5 test pattern set to an exclusive OR and multiplexing a selected perturbation  
6 matrix entry using said exclusive OR.

1           6.     A method for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 5 includes the steps of providing a  
3 perturbation matrix with a plurality of perturbation matrix entries including  
4 selected ones of no invert, all invert, a predefined bit invert; rotate, and invert  
5 rotate.

1           7.     A method for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 1 wherein the step of generating a  
3 deterministic test pattern includes the steps of using a software Pseudo  
4 Random Pattern Generator (PRPG).

1           8.     A method for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 1 wherein the step of generating a  
3 deterministic test pattern includes the steps of using a set of deterministic  
4 test patterns resident in a memory.

1           9.     A method for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 1 wherein the step of loading the  
3 deterministic test pattern into each scan chain in the device under test using  
4 lateral insertion via system data ports and applying system clocks includes  
5 the steps of applying deterministic values of the deterministic test pattern to  
6 selected one of scan chain inputs and primary inputs.

1           10.    A method for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 1 wherein the step of loading the  
3 deterministic test pattern into each scan chain in the device under test using  
4 lateral insertion via system data ports and applying system clocks includes  
5 the steps of applying perturbation deterministic values of the deterministic  
6 test pattern to selected one of scan chain inputs and primary inputs.

1           11. A method for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 1 wherein the step of loading the  
3 deterministic test pattern into each scan chain in the device under test using  
4 lateral insertion via system data ports and applying system clocks includes  
5 the steps of applying random data from a software Pseudo Random Pattern  
6 Generator (PRPG) to scan chain inputs and primary inputs.

1           12. A method for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 1 wherein the step of loading the  
3 deterministic test pattern into each scan chain in the device under test using  
4 lateral insertion via system data ports and applying system clocks includes  
5 the steps of applying output values from an exclusive OR receiving one base  
6 deterministic test pattern from a base deterministic test pattern set and a  
7 selected perturbation matrix entry.

1           13. Apparatus for implementing deterministic based broken scan  
2 chain diagnostics comprising:  
3           a set of deterministic test patterns;  
4           a test control program for loading a deterministic test pattern into  
5 each scan chain in the device under test using lateral insertion via system  
6 data ports and applying system clocks; unloading each scan chain and  
7 identifying a last switching latch in each scan chain; repeating the  
8 generating, loading, and unloading testing steps a selected number of times;  
9 and checking for consistent results and responsive to consistent results  
10 being identified, sending the identified last switching latch to a Physical  
11 Failure Analysis system.

1           14. Apparatus for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 13 wherein said set of deterministic test  
3 patterns includes a base deterministic test pattern set generated by an  
4 Automatic Test Pattern Generation (ATPG) system.

1           15. Apparatus for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 13 wherein said set of deterministic test  
3 patterns includes perturbations of one base deterministic test pattern from a  
4 base deterministic test pattern set generated by an Automatic Test Pattern  
5 Generation (ATPG) system.

1           16.   Apparatus for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 15 wherein said perturbations of one  
3 base deterministic test pattern is generated by applying said one base  
4 deterministic test pattern from the base deterministic test pattern set to an  
5 exclusive OR and multiplexing a selected perturbation matrix entry using  
6 said exclusive OR.

1           17.   Apparatus for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 16 includes a perturbation matrix having  
3 a plurality of perturbation matrix entries including selected ones of no invert,  
4 all invert, a predefined bit invert; rotate, and invert rotate.

1           18.   Apparatus for implementing deterministic based broken scan  
2 chain diagnostics as recited in claim 13 wherein said set of deterministic test  
3 patterns includes a software Pseudo Random Pattern Generator (PRPG) for  
4 generating a deterministic test pattern.

1           19.   A computer program product for implementing deterministic  
2 based broken scan chain diagnostics of a device under test in a computer  
3 test system, said computer program product including instructions executed  
4 by the computer test system to cause the computer system to perform the  
5 steps of:  
6           generating a deterministic test pattern;  
7           loading the deterministic test pattern into each scan chain in the  
8 device under test using lateral insertion via system data ports and applying  
9 system clocks;  
10          unloading each scan chain and identifying a last switching latch in  
11 each scan chain;  
12          repeating the generating, loading, and unloading testing steps a  
13 selected number of times; and  
14          checking for consistent results; and responsive to consistent results  
15 being identified, sending the identified last switching latch to a Physical  
16 Failure Analysis system.

- 1           20.    A computer program product for implementing deterministic
- 2    based broken scan chain diagnostics as recited in claim 19 includes the
- 3    steps responsive to consistent results not being identified, of selecting
- 4    another deterministic test pattern; and repeating the testing steps a selected
- 5    number of times.